Specification of minimum standard of competence for Chief Engineer officers and Second Engineer officers on ships powered by main propulsion machinery of 3000kW or more.

The STCW code distinguishes between operational level engineering, and management level engineering, which we considered to take place between the 2nd A/E and 1st A/E licenses. (U.S. conventional licensing structure). We developed our recommendations with this in mind, assuming that many of the operational skills would have already been demonstrated at the lower levels. Therefore, we focused on management level skills such as evaluating and interpreting data, knowing rules and regulations, and personnel management. There are some operational skills we felt were important enough to require demonstration- these are listed in section 1C. Our group felt that since the 1st A/E is supposed to be able to take over for the C/E if necessary, the requirements for the 1st A/E level of license would be fairly rigorous. The requirements for C/E would be one year sea time plus an additional course which would cover the higher level regulatory and management skills.

Please note that in the section dealing with fueling and ballasting (section 1E), the emphasis is on knowing procedure and regulations- not requiring a hands-on demonstration. We suggest that the demonstration be done at the operational level (2nd A/E).

Also note that some areas are specific to a particular mode of propulsion. Where this is the case, the sea time, hands-on demonstrations and required courses must be for that particular mode of propulsion, where applicable.

In reviewing this proposal, you will see that we have suggested quite a few areas which would require approved training. At the end of the table, we have provided a suggested outline of courses, with estimated time it would take to cover the material. There would be a required time investment of about 7-8 weeks for a person wishing to obtain a 1st A/E license, and an additional 4-6 weeks for someone wishing to become a Chief Engineer. This may seem like a lot, but considering that many people already attend license preparation courses when they upgrade, and that these courses often are 4-6 weeks, our proposal is not unrealistic.

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License Level	Performance Objective	Condition for Assessment	Performance Measures	Performance Standard
Function #1	**Marine Engineering at the Management Level**			
1A	**Plan and Schedule Operations**			
2nd Eng. (STCW) 1st Eng. (US) C/E	Knowledge of the key engineering principles involved with the operations of a vessel	Approved Training/ Exam	Describe the following key engineering principles as they pertain to planning and scheduling: -Thermodynamics and heat transmission -Mechanics and Hydromechanics -Operating principles of ship power installations(diesel, steam, gas turbine) -Refrigeration -Physical and chemical properties of fuels and lubrication -Technology of materials -Naval architecture and ship construction, including damage control (covered under section 4A)	Successful completion of approved training
C/E Only	Knowledge of planning all aspects of shipboard operations (overlaps with section 4E)	Approved Training	Describe the procedures involved with operations such as: -ordering supplies -scheduling preventative maintenance -complying with regulatory requirements -budgeting -safety management -inventory control -planning shipyard repair periods	Successful completion of approved training

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License Level	Performance Objective	Condition for Assessment	Performance Measures	Performance Standard
1B	**Start up and shut down main propulsion and auxiliary machinery, including associated systems.**			
2nd Eng. (STCW) 1st Eng, (U.S.)	Knowledge of the key engineering principles as they apply to the start up and shut down of main propulsion and auxiliary machinery	Approved Training/ Exam	Describe the key engineering principles as they pertain to the start up and shut down of main propulsion and auxiliary machinery: -Thermodynamics and heat transmission -Mechanics and Hydromechanics -Operating principles of ship power installations(diesel, steam, gas turbine) -Refrigeration -Physical and chemical properties of fuels and lubrication -Technology of materials -Naval architecture and ship construction, including damage control	Successful completion of approved training
1C	**Operate, monitor and evaluate engine performance and capacity (steam, diesel, gas turbine)**			
2nd Eng. (STCW) 1st Eng, (U.S.)	Start main engine.	Aboard ship /simulation	Demonstrate start up of the main propulsion engine for departure, including all necessary checks and actions to ensure that the auxiliary and control systems are functioning satisfactorily.	Use of equipment and procedures is appropriate and safe.
2nd Eng. (STCW) 1st Eng, (U.S.)	Operate main engine in maneuvering conditions.	Aboard ship /simulation	Demonstrate operation of main propulsion machinery in maneuvering situation, including all necessary checks and actions to ensure that the auxiliary and control systems are functioning satisfactorily.	Use of equipment and procedures is appropriate and safe.
2nd Eng. (STCW) 1st Eng, (U.S.)	Transfer from maneuvering to at sea conditions, and vice versa.	Aboard ship /simulation	Demonstrate transferring from maneuvering to at sea conditions, and vice versa, including all necessary checks and actions to ensure that the auxiliary and control systems are functioning satisfactorily.	Use of equipment and procedures is appropriate and safe.
Chief Engineer	(Supervise) Operate, monitor and evaluate performance of main engine.	Approved Training	Demonstrate operation, monitoring, and evaluation of main engine including load capacity, firing pressures, etc. Make all necessary checks and actions to ensure that the auxiliary and control systems are functioning satisfactorily, and that the engine performance is within technical specifications.	Successful completion of approved training.

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License Level	Performance Objective	Condition for Assessment	Performance Measures	Performance Standard
1C	**Operate, monitor and evaluate engine performance and capacity (steam, diesel, gas turbine), cont.**			
2nd Eng. (STCW) 1st Eng, (U.S.)	Secure main engine.	Aboard ship /simulation	Demonstrate securing of main engines, including all necessary checks and actions to ensure that the auxiliary and control systems are functioning satisfactorily.	Use of equipment and procedures is appropriate and safe.
2nd Eng. (STCW) 1st Eng, (U.S.)	Start ship's service generator.	Aboard ship /simulation	Demonstrate start up of the ship's generator, including all necessary checks and actions to ensure that the systems are functioning satisfactorily.	Use of equipment and procedures is appropriate and safe.
Chief engineer	Evaluate performance of ship's service generator.	Approved Training	Demonstrate operation, monitoring, and evaluation of ship's service generator including load capacity, firing pressures, etc. Make all necessary checks and actions to ensure that the auxiliary and control systems are functioning satisfactorily, and that the engine performance is within technical specifications.	Successful completion of approved training.
2nd Eng. (STCW) 1st Eng, (U.S.)	Parallel ship's generators	Aboard ship /simulation	Demonstrate the proper paralleling of generators, including load transferring between all auxiliary generators. Make all necessary checks and actions to ensure that the systems are functioning satisfactorily.	Use of equipment and procedures is appropriate and safe.
2nd Eng. (STCW) 1st Eng, (U.S.)	Secure ship's generators	Aboard ship /simulation	Demonstrate securing the ship's generator, including all necessary checks and actions to ensure that the systems are functioning satisfactorily.	Use of equipment and procedures is appropriate and safe.
2nd Eng. (STCW) 1st Eng, (U.S.)	Transfer power from ship's power to shore power, and vice versa.	Aboard ship /simulation	Demonstrate transferring from ship's power to shore power, and vice versa, including all necessary checks and actions to ensure that the systems are functioning satisfactorily.	Use of equipment and procedures is appropriate and safe.

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License Level	Performance Objective	Condition for Assessment	Performance Measures	Performance Standard
1C	**Operate, monitor and evaluate engine performance and capacity (steam, diesel, gas turbine) (cont.)**			
2nd Eng. (STCW) 1st Eng, (U.S.)	Start emergency generator and transfer load to and from the emergency buss.	Aboard ship /simulation	Demonstrate start up of emergency generator and transfer load to and from the emergency buss, including all necessary checks and actions to ensure that the systems are functioning satisfactorily.	Use of equipment and procedures is appropriate and safe.
2nd Eng. (STCW) 1st Eng, (U.S.)	(Supervise) Operate and perform routine and preventative maintenance of auxiliary boiler and incinerator.	Aboard ship /simulation	Demonstrate operation and maintenance of auxiliary boiler plant and incinerator, including all necessary checks and actions to ensure that the systems are functioning satisfactorily.	Successful completion of approved training.
Chief engineer	Evaluate performance of auxiliary boiler plant and incinerator	Approved Training	Evaluate operation and maintenance of auxiliary boiler plant and incinerator, including all necessary checks and actions to ensure that the systems are functioning satisfactorily.	Successful completion of approved training.
2nd Eng. (STCW) 1st Eng, (U.S.)	Perform steering gear test in accordance with regulations, including operation in all modes.	Aboard ship /simulation	Demonstrate performance of steering gear test in accordance with regulations, including operation in all modes.	Use of equipment and procedures is appropriate and safe.
2nd Eng. (STCW) 1st Eng, (U.S.)	Start, operate and secure, and perform routine and preventative maintenance on refrigeration and A/C systems.	Approved training/ approved shipboard experience	-Demonstrate starting, operation, securing and routine and preventative maintenance on refrigeration and A/C systems, including adding refrigerant, evacuating system, pumping down, adding oil, and recovering refrigerant in accordance with all applicable regulations. -Demonstrate proper record keeping in accordance with regulations -Show valid Refrigeration technician card as required by 40 CFR Part 82, subpart F.	Use of equipment and procedures is appropriate and safe.
2nd Eng. (STCW) 1st Eng, (U.S.)	Operation, repair and perform routine and preventative maintenance on deck machinery/ cargo handling equipment.	Approved training /simulation	Demonstrate starting , operating, securing and routine and preventative maintenance on deck machinery/ cargo handling equipment.	Use of equipment and procedures is appropriate and safe.

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License Level	Performance Objective	Condition for Assessment	Performance Measures	Performance Standard
1C	**Operate, monitor and evaluate engine performance and capacity (steam, diesel, gas turbine) (cont.)**			
2nd Eng. (STCW) 1st Eng, (U.S.)	Start, operate and secure, and perform routine and preventative maintenance on oily water separator and waste oil system.	Aboard ship /simulation	Demonstrate starting, operating, securing and routine and preventative maintenance on oily water separator and waste oil system, including the following: -operation of OWS in accordance with USCG and environmental regulations -transfer of waste oil within ship -disposal of waste oil in accordance with regulations -Demonstrate proper record keeping in accordance with regulations.	Use of equipment and procedures is appropriate and safe.
	Operate, test and maintain control systems.		Satisfied under section 2	
1D	**Maintain safety of engine equipment, systems and services.**			
2nd Eng. (STCW) 1st Eng, (U.S.)	Knowledge of safety as it applies to shipboard operations (regulatory, human element, environmental)	Approved Training	Describe the aspects of safety which apply to shipboard operations, including: -regulatory requirements -human element -environmental elements	Successful completion of approved training.
1E	**Managing fuel and ballast operations.**			
2nd Eng. (STCW) 1st Eng, (U.S.) *require hands on demonstration at 2nd A/E level	Knowledge of how to perform and supervise fuel transfer procedures between tanks aboard ship.	Approved training	Describe the procedures involved with the transferring of fuel between tanks aboard ship, including the following: -Proper communication -Completing all required forms and documents -Monitoring of tanks during transfer	Successful completion of approved training

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License Level	Performance Objective	Condition for Assessment	Performance Measures	Performance Standard
1E	**Managing fuel and ballast operations.**			
2nd Eng. (STCW) 1st Eng, (U.S.) *require hands on demonstration at 2nd A/E level	Knowledge of how to perform and supervise bunkering operations in compliance with regulations.	Approved training	Describe bunkering operations aboard ship. Demonstration will include the following: -Lining up of fuel oil manifold -Operating pumps -Ensuring that containment equipment is in place. -Proper communication -Awareness of all applicable regulations. -Completing all required forms and documents -Monitoring of tanks during transfer -company, local, state, federal and international regulations as they apply to fueling -Proper securing of systems when transfer is complete.	Successful completion of approved training
2nd Eng. (STCW) 1st Eng, (U.S.) *require hands on demonstration at 2nd A/E level	Knowledge of how to perform and supervise ballasting operations in compliance with regulations.	Approved training	Demonstrate ballasting operations aboard ship. Demonstration will include the following: -Lining up of ballast manifold -Operating pumps -Ensuring that containment equipment is in place. -Proper communication -Awareness of all applicable regulations. -Completing all required forms and documents -Monitoring of tanks during transfer -Proper securing of systems when transfer is complete.	Successful completion of approved training
1F	**Use internal communications systems.**			
2nd Eng. (STCW) 1st Eng, (U.S.) Chief Engineer	Knowledge of effective use and operation of all internal communication systems.	Approved Training	Demonstrate effective use and operation of all internal communication systems, including telegraph, telephones, radios. Describe effective communication theory, required documentation, use during bunkering and emergency situations.	Successful completion of approved training, or use of equipment is appropriate and safe.

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License Level	Performance Objective	Condition for Assessment	Performance Measures	Performance Standard
Function #2	**Electrical, electronic and control engineering at the management level.**			
2A	**Operate, maintain, troubleshoot and repair pneumatic, electrical, electronic and digital control equipment.**			
2nd Eng. (STCW) 1st Eng, (U.S.)	Knowledge of Electrical Troubleshooting (motors, controllers, generators, high voltage)	Approved Training	Basic identification and troubleshooting of the following: -test equipment - schematic symbols and diagrams -AC and DC components -AC and DC circuits -3 phase motors -protective devices and control system components -shock hazards and precautions - motor controllers - programmable logic controllers	Successful completion of approved training.
2nd Eng. (STCW) 1st Eng, (U.S.)	Knowledge of analog and digital electronics.	Approved Training	Basic identification and troubleshooting of the following: - component packaging - lab equipment and soldering - discrete semiconductor components - DC power supplies - operational amplifiers - analog sensors and signal conditioning - binary logic - memory concept - serial vs. parallel transmission	Successful completion of approved training.
2nd Eng. (STCW) 1st Eng, (U.S.)	Knowledge of instrumentation and control systems. (Pneumatic, electronic, hydraulic)	Approved Training	Basic identification and troubleshooting of the following: - control loops -measurement and calibration -control strategies, basics, and tuning -final control elements -data communications -troubleshooting	Successful completion of approved training.

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License Level	Performance Objective	Condition for Assessment	Performance Measures	Performance Standard
Function #3	**Maintenance and repair at the management level.**			
3A	**Organize safe maintenance and repair procedures.**			
2nd Eng. (STCW) 1st Eng, (U.S.)	Knowledge of safe maintenance and repair procedures.	Approved Training	Describe how maintenance and repair procedures are planned and carried out in accordance with technical, legislative, safety and procedural specifications.	Successful completion of approved training.
3B	**Detect and identify the cause of machinery malfunctions and correct faults.**			
2nd Eng. (STCW) 1st Eng, (U.S.)	Knowledge of troubleshooting procedures and how to the plant to normal operating conditions. (diesel, steam, gas turbine)	Approved Training/ Simulation	Describe and demonstrate effective troubleshooting techniques for a ship's propulsion and power generation plant. (diesel, steam, gas turbine).	Successful completion of approved training.
3C	**Ensure safe working practices.**			
C/E only	Knowledge of safe working practices.	Approved Training	Describe safe working practices in terms of legislative requirements, permits to work, and environmental concerns.	Successful completion of approved training.
Function #4	**Controlling the ship and care for persons on board at the management level.**			
4A	**Control trim, stability and stress.**			
C/E only	Knowledge of fundamental principles of ship construction, trim, stress, stability and damage control.	Approved Training	Describe the fundamental principles of the following: -Ship construction and related terminology, including strength and structure. -stability, including static initial stability, overall stability, weight effects on stability, the ship in motion (turning, pitching, heaving, yawing). -flooding and damage control including reserve buoyancy, free surface effect, free communication, drydocking and stranding.	Successful completion of approved training.

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License Level	Performance Objective	Condition for Assessment	Performance Measures	Performance Standard
4B	**Monitor and control compliance with legislative requirements and measures to ensure safety of life at sea and protection of the marine environment.**			
C/E only	Knowledge of relevant maritime law pertaining to international agreements and conventions, safety and the environment.	Approved Training	Describe the following: -What certificates and other documents are required to be carried on board ships by international conventions, how they may be obtained, and the period of their legal validity. -Responsibilities under the relevant requirements of the International Convention of Load Lines. -Responsibilities under the relevant requirements of the International Convention for the Safety of Life at Sea. -Responsibilities under the International Convention for the Prevention of Pollution from Ships. -Maritime declarations of health and the requirements of the International Health Regulations.	Successful completion of approved training.
4B	**Monitor and control compliance with legislative requirements and measures to ensure safety of life at sea and protection of the marine environment. (cont.)**			
C/E only	Knowledge of relevant maritime law pertaining to international agreements and conventions, safety and the environment. (cont.)	Approved Training	-Responsibilities under international instruments affecting the safety of the ships, passengers, crew or cargo. -Methods and aids to prevent pollution of the environment by ships. -national legislation for implementing international agreements and conventions. -Responsibilities under the International Safety Management system.	Successful completion of approved training.

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License Level	Performance Objective	Condition for Assessment	Performance Measures	Performance Standard
4C	**Maintain Safety and security of the vessel, crew and passengers and the operational condition of life-saving, fire-fighting and other safety systems.**			
C/E only	Knowledge of life-saving regulations as it pertains to equipment and training. (SOLAS)	Approved Training	Describe SOLAS regulations as they apply to equipment and training.	Successful completion of approved training.
C/E only	Knowledge of planning fire, abandon ship and emergency drills.	Approved Training	Describe how to plan effective fire, abandon ship and emergency drills.	Successful completion of approved training.
C/E only	Knowledge of how to protect the persons on board during an emergency, and how to limit damage and salve the ship following fire, explosion collision or grounding. (covered in 4A)	Approved Training	Describe actions to be taken to protect persons on board during an emergency. Describe how to limit damage and salve the ship following fire, explosion, collision or grounding.	Successful completion of approved training.
C/E only	Knowledge of how to maintain life-saving, fire-fighting, fire detecting and other safety systems in operational condition.	Approved Training	Describe proper methods for maintaining life-saving, fire-fighting, fire detecting and other safety systems in good operating condition.	Successful completion of approved training.
4D	**Develop emergency and damage control plans and handle emergency situations.**			
	Covered under sections 4A and 4C			
4E	**Organize and manage the crew.**			
C/E only	Knowledge of international maritime conventions and recommendations and related national legislation. (covered under section 4B)		Covered under section 4B	
2nd Eng. (STCW) 1st Eng, (U.S.)	Knowledge of personnel management, organization and training aboard ships. (overlaps with section 1A)	Approved training	Engine room Resource Management (ERM)	Successful completion of approved training.

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License Level	Performance Objective	Condition for Assessment	Performance Measures	Performance Standard
4E	**Organize and manage the crew. (cont.)**			
C/E only	Knowledge of personnel management, organization and training aboard ships. (overlaps with section 1A)	Approved Training	Describe recommended methods of handling the following: -being an effective leader -employee performance -setting standards and goals -counseling -motivating people -team building -planning and participating in meetings -employee behavior problems -labor contracts -grievances -planning shipyard repairs -writing shipyard specifications -writing effective reports and letters -writing and working with a budget -managing surveys and inspections in accordance with ABS, USCG, ISM and IMO regulations. -Engine room Resource Management (ERM)	Successful completion of approved training.

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Definition of Terms:

Describe: The candidate will communicate through written form, a comprehensive knowledge of the task or criteria to a designated examiner. "Describe" assessments may also be satisfied by individual demonstration.

Demonstrate: The candidate will individually perform the task (using in-service experience, approved training ship experience, approved simulator training where appropriate, or approved laboratory equipment training) under the supervision or guidance of a designated examiner or observer and verified by a licensed officer using criteria provided by a designated examiner for the purpose of assessment.

Operate: Start, place into service, monitor and secure machinery.

Note: It is recognized that through the continual and frequent observation of certain performance based demonstrations where detrimental harm may occur to required machinery, equipment or systems, an alternative plan can be employed utilizing partial performance observations to include a combination of shipboard equipment, computer simulations, mechanical mock-ups, etc., or a combination of these as long as the outcome is capable of replicating 100% of the indicated task conducted aboard ship.

Summary of Proposed Courses:

<u>First Assistant Engineer</u>

Engineering principles- theory and applied (section 1A & 1B) Safety (regulations, human element, environmental) (Section 1D & 3A) Fueling and Ballasting procedures and regulations (section 1E) Communication (section 1F) ERM (section 4E)	Leadership & Management for 1st A/E (1-2 weeks)
Machinery troubleshooting (section 3B) Deck machinery (section 1C)	Combined course (1 week)
Refrigeration (section 1C)	1 week
Electrical troubleshooting (section 2A) Analog and digital electronics (section 2A) Instrumentation (section 2A)	Combined course (4 weeks)
	Total course time for 1st A/E= 7-8 weeks

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Chief Engineer

Leadership & Management course

Shipboard planning (section 1A, 4E)
Communication (section 1F)
Safety (section 3C)
Maritime Law, safety (section 4B, 4C, 4E)
Main engine, generator and boiler evaluation (section 1C)
Stability and damage Control (section 4A, 4C)
ERM (section 4E)

Total course time 4-6 weeks.

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